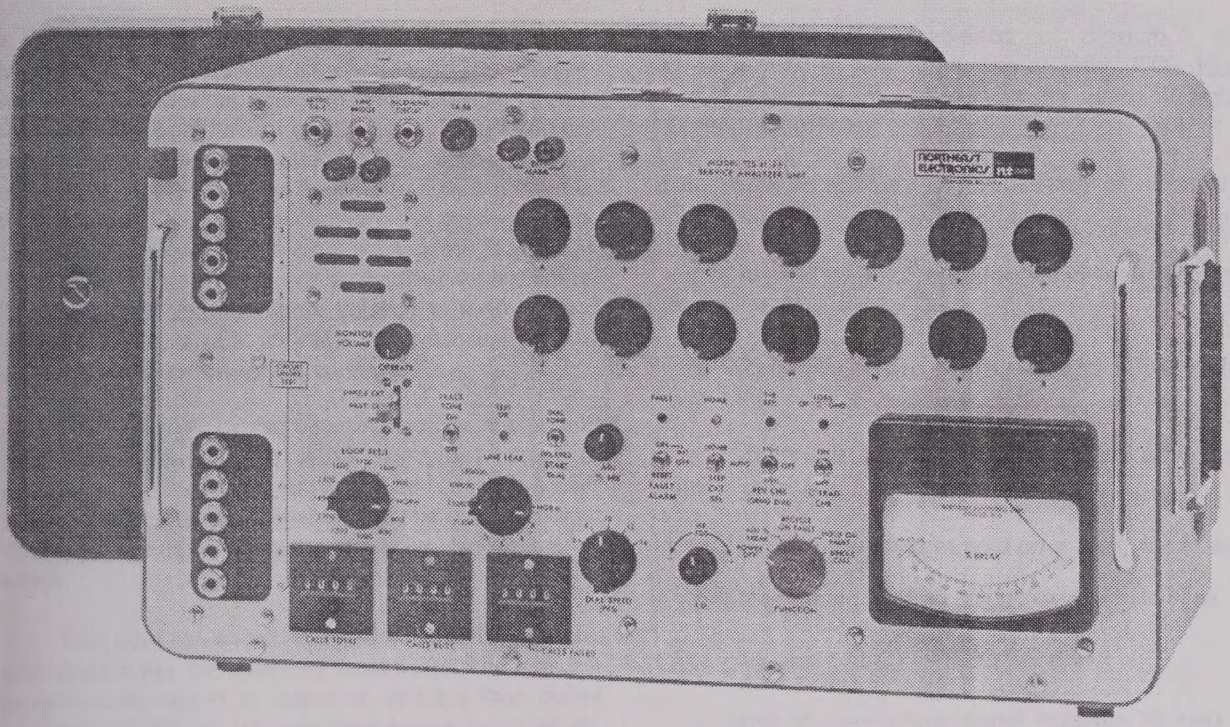
SERVICE ANALYZER
NORTHEAST ELECTRONICS
TTS 41-2A
SHOP



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INSTRUCTION MANUAL

PRINTED IN U.S.A.

TTS 41-2A
SERVICE ANALYZER

No. A0041-12-600 ISSUE 2 DATE AUG 1977

SECTION 1

GENERAL DESCRIPTION

1.1 This manual covers the Northeast Electronics Model TTS 41-2A Service Analyzer Unit. The analyzer routines central office equipment and can hold circuits for a variety of call failure conditions . . . start dial not received, tip/ring reversal during dialing, 1-kHz tone not received, open C-lead after seizure, assigned connector not reached. The analyzer can vary the pulsing speed, the interdigital period, the loop resistance and line leak conditions for testing circuits to marginal failure limits. The individual test conditions needed to exercise and check different aspects of office performance are easily programmed via front panel controls.

1.2 The analyzer can also be instructed not to stop and hold upon detection of a circuit failure, but instead to continue originating new test calls after pegging a calls failed counter. Thus, the analyzer may be used to collect data useful in determining the overall trouble level in an office.

1.3 Test calls can be originated on up to 10 telephone lines jacked into the analyzer's front panel. The lines are automatically seized in sequence, and are loop dialed to either a 1000-Hz milliwatt tone source or to an assigned connector terminal wired back to the analyzer.

1.4 The lines may be 2-lead (T/R) or 3-lead (T/R/S) types. A C-lead ground on any line is recognized as a busy indication, and that line is skipped until it becomes idle. Also, the analyzer automatically forwards ground on the C-lead to busy the circuit during dialing and to hold switched connections for troubleshooting.

1.5 Digits of the number to be dialed are programmed on 14 front panel switches. The analyzer can be instructed to start dialing:

a. upon receipt of dial tone following line seizure, or

b. after a time delay (4 seconds nominal) elapses following line seizure.

Outpulsing speeds of 6, 8, 10, 12, and 14 pps are selectable. Percent break can be set anywhere between 30 and 85 percent. Additional switches permit insertion of fixed loop resistance values from 0 to 1900 ohms and/or standard line leak conditions . . . normal, A, B, C, D. Four resistive leak conditions of 7150, 7500, 10,000, and 15,000 ohms are also included for use in Stromberg-Carlson XY offices.

1.6 Three resettable front-panel peg counters show tabulations of:

a. CALLS TOTAL . . . counts all calls originated by the analyzer.

b. CALLS BUSY . . . counts all calls which return a busy tone.

c. CALLS FAILED . . . counts all calls for which a fault is detected.

1.7 When programmed to hold on a fault, the analyzer:

a. holds the dc holding bridge on the failed line.

b. pegs the CALLS FAILED counter;

c. lights an appropriate panel indicator to mark the type of fault;

d. sounds an internal alarm if so programmed;

e. makes a contact closure which may be used to operate an external alarm.

1.8 An internally-generated tracing tone may be coupled onto any line held by the analyzer to aid in following switched connections through an office. The tracing tone is a distinctive 1150-Hz tone interrupted 5 times a second.

1.9 A single call capability is also selectable. This permits outpulsing of only one call and then holding the circuit regardless of call results.

1.10 A monitor amplifier and speaker are built-in. A line bridging jack on the front panel gives access to a line under test so that additional test instruments may be conveniently connected to that line.

SECTION 2

SPECIFICATIONS

2.1 Overall specifications of the TTS 41-2A Service Analyzer Unit are listed in Table 2—1.

Table 2—1. Overall Specifications

ORIGINATING LINES	
Line Capacity	up to 10 lines
Types	wet loop 2-lead (T/R) or 3-lead (T/R/S); either dedicated or non-dedicated trunks
DIALING	
Speed	selectable 6, 8, 10, 12, or 14 pps with accuracy of ± 2%
Percent Break	adjustable 15 to 85% with accuracy of ±3%
Interdigit Interval	adjustable 0.1 to 1 second
Digit Capacity	up to 14 numeric digits
Start Dial Commands	(a) dial tone detection, or (b) 4-second time delay after seizure (internally adjustable)
Dial Pulsing Parameters	
Loop Resistance	switchable in 200-ohm increments from 600 to 1200 ohms and in 100-ohm increments from 1200 to 1900 ohms
Leak Conditions	Leak A - series circuit of 2 microfarads and 5,050 ohms in parallel with 10,250 ohms Leak B - 10,250 ohms Leak C - series circuit of 2 microfarads and 600 ohms in parallel with 10,250 ohms Leak D - series circuit of 2 microfarads and 600 ohms in parallel with 20,250 ohms Selectable resistive leakage of 7,150; 7,500; 10,000 and 15,000 ohms for use in Stromberg-Carlson XY offices
ANALYTIC CAPABILITIES	
Conditions Detected	(a) start dial not received (b) tip/ring reversal during dialing

Table 2—1. (cont'd)

nitions Detected (cont'd)	(c) 1-kHz tone not received
	(d) open C-lead after seizure
	(e) assigned connector not reached
	(f) busy tone
s Data Accumulations	up to 9,999 counts on each counter for "calls total", "calls busy", and "calls failed"
s Interrogation	45 seconds (internally adjustable)
ECTORS AND GENERATOR	
a Tone Detector	
evel	down to −30 dBm
requency	greater than 200 Hz
Ring Reversal Detector	
teversal Duration	110 milliseconds or more (reversal durations less than 40 milliseconds are ignored)
oltage	3 volts across tip and ring
z Tone Detector	
) dBm Detection Range	960 to 1055 Hz
-30 dBm Detection Range	975 to 1035 Hz
) dBm Non-Detection Range	less than 900 Hz or greater than 1150 Hz
−30 dBm Non-Detection Range	less than 940 Hz or greater than 1080 Hz
ead Detector	
Busy Recognition	ground or any voltage more positive than −4.5 ± 1V
Loss of C-Lead Recognition	Any voltage more negative than −10V for 1200 milliseconds or more (durations less than 400 milliseconds are ignored)
oming Circuit Detector	recognizes ground through a resistance up to 150 ohms
y Tone Detector	
Frequency	200 to 800 Hz
Level	−30 dBm or more
Tone/No-Tone Threshold	10 dB drop in tone level

Table 2—1. (cont'd)

Interruption Rate	50 to 70 ipm at 50 percent break
Percent Break	40 to 60 percent break at 60 ipm
Trace Tone Generator	
Frequency	1150 ± 345 Hz
Interruption Rate	300 ± 90 ipm
Level	−20 dBm into 600 ohms
GENERAL	
Power Requirements	
Voltage	−42 to −56 Volts
Current Drain	1 Amp maximum
Physical Characteristics	
Width x Height x Depth	21½ x 12½ x 10 inches (54.6 x 30.5 x 25.4 cm)
Weight	34.5 lbs (15.6 kg)

SECTION 3

INSTALLATION

3.1 This section contains the information needed to prepare the TTS 41-2A Service Analyzer for use. The information includes:

a. initial inspection,

b. power requirements, and

c. interfacing.

3.2 INITIAL INSPECTION

3.3 The Service Analyzer Unit was carefully inspected, both mechanically and electrically, before shipment. It should be free of defects and should be operating correctly when received. The analyzer should be inspected for damage in transit. If damage has occurred, file a claim with the carrier.

3.4 POWER REQUIREMENTS

3.5 The Service Analyzer Unit can be operated from a −42 to −56 Vdc power source capable of supplying up to 1 ampere of current.

3.6 INTERFACE REQUIREMENTS

3.7 Most input/output connectors on the analyzer accept type-310 plugs. The circuit selector cables should be either 2-lead (tip, ring) or 3-lead (tip, ring, sleeve) cables as appropriate for the circuits to be tested. The incoming circuit connector needs only a sleeve connection. The input power connector requires a 2-lead (tip = −48 Vdc and sleeve = ground) cable. The T/R and EXT ALARM binding posts are spaced to accept standard dual banana plugs.

3.8 ENVIRONMENTAL REQUIREMENTS

3.9 OPERATING TEMPERATURE

3.10 For the analyzer to operate within the specifications listed in Table 2−1, the operating temperature must be within the range of 0 to +50°C (+32 to +122°F).

3.11 RELATIVE HUMIDITY

3.12 The relative humidity allowable for proper operation of the analyzer is 10 to 95%.

3.13 PREPARATION FOR USE

3.14 The Service Analyzer Unit requires little preparation for use. Place the analyzer on a convenient work surface and remove the front cover. The analyzer may be used in a vertical position (standing on its side) or in a horizontal position (standing on its back).

SECTION 4

OPERATION

4.1 This section provides information needed for proper operation of the Service Analyzer Unit in a variety of applications. The information is organized as follows:

a. Brief description of front panel **controls, indicators, and jacks** (paragraph 4.2);

b. Procedures for setting up the analyzer in one of its three **basic operating modes** . . . recycle on fault, hold on fault, or single call . . . (paragraph 4.4);

c. Procedures and information needed for using analyzer in a number of **applications** (paragraph 4

4.2 FRONT PANEL CONTROLS, INDICATO AND JACKS

4.3 Figure 4—1 shows the front panel controls, cators and jacks, Table 4—1 briefly describes the f tion of each.

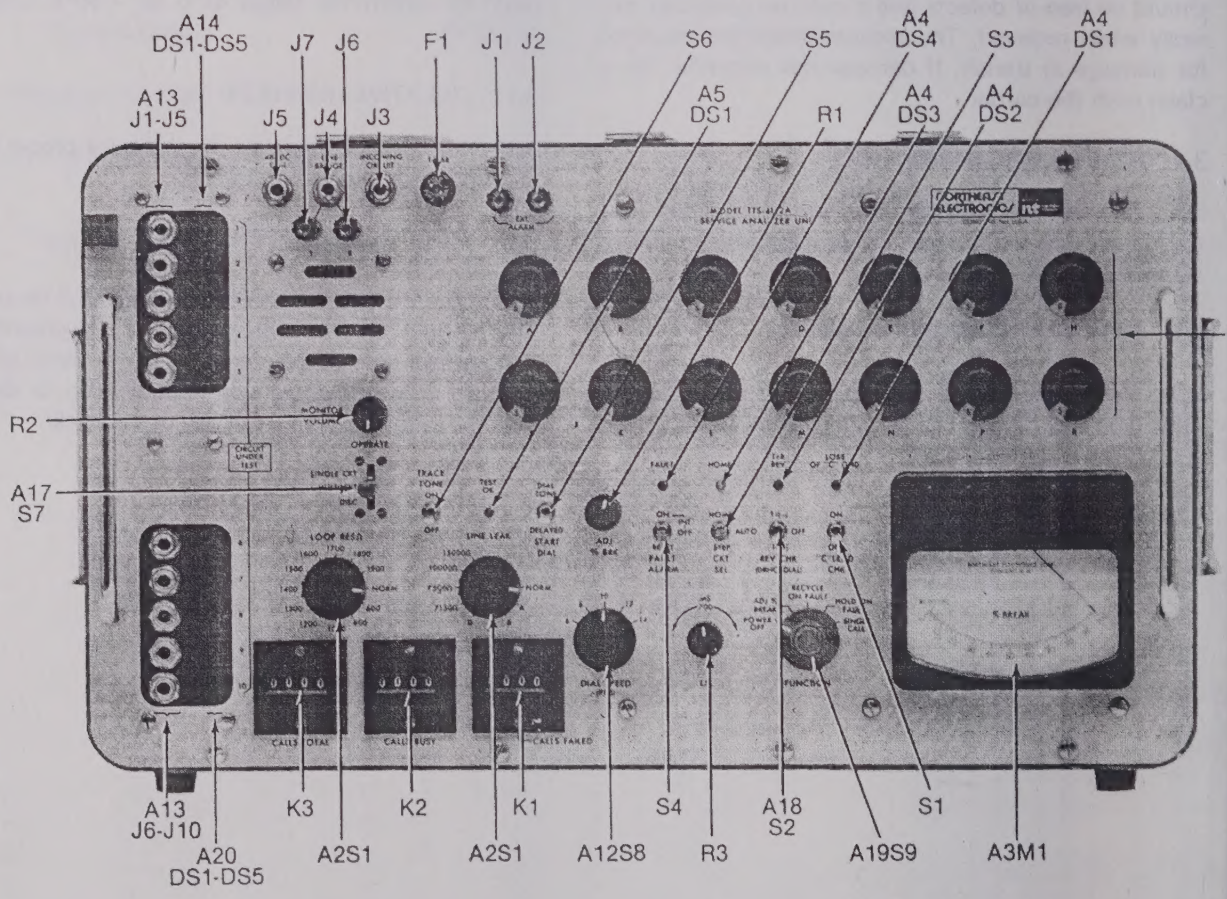


Figure 4—1. Controls, Indicators, And Jacks

Table 4—1. Controls, Indicators, And Jacks

FERENCE SIGNATION	NOMENCLATURE	DESCRIPTION
J5	48 VDC T=(−) 310 jack	Accepts input power from −42 to −56 Vdc. Tip is negative and sleeve is ground.
J4	LINE BRIDGE 310 jack	Bridges the tip, ring, and sleeve of the circuit under test chosen by the unit's circuit selector.
J6, J7	R, T binding posts	Provide alternate method to bridge across the tip and ring of the circuit under test.
J3	INCOMING CIRCUIT 310 jack	A test okay result is recorded when a ground is sensed on the sleeve of the incoming circuit jack.
	1A-SB fuse	Protects against excessive current on the input power line.
, J2	EXT ALARM binding posts	Provides a closure when a fault is detected. May be used to trigger an external alarm. Contact rating is 10 volt-ampere maximum. Current rating is 1 ampere maximum.
13J1-J10	CIRCUIT UNDER TEST 310 jacks	Provides test connections for up to 10 circuits. Wet loop 2-lead (tip and ring) or 3-lead (tip, ring, and sleeve).
14DS1-DS5 20DS1-DS5	CIRCUIT UNDER TEST light emitting diodes	Provide a visual display of the selected circuit under test. LED blinks in the presence of dial pulses.
S1	speaker	Provides an audio indication of the signals present on the circuit under test. Monitor speaker is shut off when TRACE TONE switch is set at ON.
2	MONITOR VOLUME potentiometer	Adjusts the audio volume.
A6S1-S14	Number selector A, B, C, D, E, F, H, J, K, L, M, N, P, R 11-position rotary switches	Provide programming of the number to be dialed, starting with number selector A. The number selector following the last digit of the number to be dialed must be set at S (stop) position. Example: A B C D E F H J K L M N P R 9 1 3 9 2 4 6 0 1 1 S N, P, R may be set in any positions.

Table 4—1. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
A17S7	OPERATE 3-position key switch	Provides for testing one circuit (SINGLE CKT) or mo... than one circuit (MULTI CKT). In DISC position, the c... cuit selector goes to the next connected circuit or ... home position. The analyzer then remains on-hook. NOTE OPERATE switch must be set at DISC when: a. No circuits are connected to the circuit selector jacks, b. FUNCTION switch is set at ADJ % BREAK, or c. While changing CKT SEL switch positions.
S6	TRACE TONE 2-position toggle switch	When set at ON: 1) places a ground on the sleeve of the circuit u... test, 2) disables the monitor amplifier to inhibit the speak... 3) generates an interrupted tone across the tip and ... of the circuit under test. TRACE TONE should **not** be set at ON when the OPE... ATE switch is set at DISC (analyzer on hook) since ... causes the circuit selector to continuously advance wh... the OPERATE switch is moved off the DISC positio...
A5DS1	TEST OK light emitting diode	Lights to indicate that the analyzer has complete... call without detecting any faults.
S5	START DIAL 2-position toggle switch	DIAL TONE - analyzer starts dialing after 1 second... dial tone. DELAYED - analyzer starts dialing 4 seconds after ... seizure (off hook).
R1	ADJ % BRK potentiometer	Adjusts the percent break between 15% and 85%. ... FUNCTION switch must be set at ADJ% BREAK w... making percent break adjustments.

Table 4—1. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
S4	FAULT ALARM 3-position toggle switch	ON INT - provides an audible alarm on the speaker when a fault is detected. INT OFF - sounds no audible alarm if a fault is detected. RESET - momentary contact that: 1) silences the internal alarm if on, 2) resets the fault detection circuits, and 3) turns off any lighted fault indicators.
A4DS4	FAULT light emitting diode	Lights to indicate that a fault has been detected.
S3	CKT SEL 3-position toggle switch	HOME - momentary contact when held up, causes the circuit selector to advance to home position. OPERATE switch should be set at DISC otherwise the circuit selector will advance past the home position. AUTO - allows normal advancement of the circuit selector under control of the OPERATE switch. STEP - momentary contact causes the circuit selector to advance to the next connected circuit or to home.
A4DS3	HOME light emitting diode	Lights to indicate that the circuit selector is in home position (no circuit is selected).
A18S2	REV CHK (DRNG DIAL) 3-position toggle switch	T = (−) - analyzer senses if the tip lead becomes positive with respect to the ring during an interdigital period. OFF - analyzer does not search for tip ring reversal during an interdigital period. T = (+)-analyzer senses if the tip lead becomes negative during an interdigital period.
A4DS2	T-R REV light emitting diode	Lights to indicate that a tip ring reversal during interdigital period has been detected.
S1	"C" LEAD CHK 2-position toggle switch	When set at ON, analyzer checks for loss of C-lead ground.

Table 4—1. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
A4DS1	LOSS OF "C" GND light emitting diode	Lights to indicate that loss of ground on C-lead h been detected.
A3M1	meter	Provides a visual display of percent break when FUN TION switch is set at ADJ % BREAK.
A2S1	LOOP RES Ω 12-position rotary switch	Selects loop resistance.
A2S2	LEAK 9-position rotary switch	Selects leak conditions placed across the tip and rin
S8	DIAL SPEED (PPS) 5-position rotary switch	Selects dial pulsing speed of 6, 8, 10, 12, or 14 puls per second.
R3	I.D. potentiometer	Adjusts the interdigital period between 100 and 10 milliseconds.
A19S9	FUNCTION 5-position rotary switch	POWER OFF - disconnects power from test set. ADJ % BREAK - enables percent break meter for adju ing the percent break. OPERATE switch should be at DISC for percent break adjustment. RECYCLE ON FAULT - analyzer goes on-hook and p ceeds to next test call even through a fault has be detected. HOLD ON FAULT - analyzer remains off-hook if a fa has been detected. SINGLE CALL - analyzer makes one test call and st off-hook regardless of test results.
K3	CALLS TOTAL counter	Records number of calls attempted. Pegs one cou upon seizure (off-hook).
K2	CALLS BUSY counter	Records number of calls that return busy tone. Pe one count after 7 or more busy tone bursts.
K1	CALLS FAILED counter	Records number of calls for which a fault was detect Pegs one count after a fault detection occurs.

GENERAL OPERATING INSTRUCTIONS

Figure 4—2 outlines, in flow chart form, the pro-res needed to set up and program the analyzer for g circuits. One of three operating modes (recycle ult, hold on fault, or single call) may be selected.

The **recycle on fault** mode may be used for ning office equipment. In this mode the analyzer nues to place calls even though faults are encount- Upon occurrence of a fault, the CALLS FAILED ter is pegged. The recycle on fault mode is helpful termining the overall level of trouble in an office.

In the **hold on fault** mode, the analyzer:

stops when it detects a fault,

maintains the dc holding bridge across the circuit,

sounds an internal alarm, and

lights appropriate indicators to mark the type of encountered.

CALLS FAILED indicator is also pegged. The an-er's internal trace tone may be injected into the cir-under test to trace the call's progress through the e switching equipment. Ancillary test equipment be connected to the circuit under test via the an-er's LINE BRIDGE jack.

In **single call** mode, the analyzer places one only and then holds the circuit under test. The single mode may be used to perform additional tests, such transmission tests using a Northeast Electronics 44 Transmission Test Set.

TYPICAL ANALYZER APPLICATIONS

The following paragraphs describe three typical lications for the TTS 41-2A Service Analyzer Unit. first two applications show how the analyzer inter-nects with telephone equipment to perform basic tining tasks. The third application shows how the analyzer may be used with a Northeast Electronics Model 4101 Identifier to detect failures of common control equipment.

4.11 ROUTINING A STEP BY STEP (SXS) CENTRAL OFFICE

4.12 The analyzer can routine a SXS central office having up to 1000 lines without changing the test installation. Figure 4—3 shows how the analyzer connects to telephone switching equipment to perform the routining task. As shown in Figure 4—3, test calls are placed to a test number connector. The sleeve of this test number connector returns a ground when the call has successfully reached this point in the switch train.

4.13 To routine a SXS central office, connect the office equipment to the analyzer as shown in Figure 4—3. Set up and program the analyzer to recycle on fault as outlined in Figure 4—2.

4.14 ROUTINING OUTGOING TRUNKS

4.15 The analyzer can routine trunks outgoing from a central office. Figure 4—4 shows the analyzer connected to outgoing trunks in a central office to perform this routining task. Refer to Figure 4—2 for an outlined procedure on how to set up and program the analyzer.

4.16 CHECKING SHARED EQUIPMENT IN A COMMON CONTROL CENTRAL OFFICE

4.17 The Service Analyzer Unit, when used in conjunction with a Northeast Electronics Model 4101 Identifier, can help diagnose call completion failures within a common control office. The Model 4101 displays the identity of the common control equipment used to service the call. This information may be used to pinpoint faulty common control equipment.

4.18 Figure 4—5 shows the interconnections needed to test a common control central office. The analyzer should be set up to hold on fault as outlined in Figure 4—2. Note that the Identifier INPUT LINE jack connects to the analyzer LINE BRIDGE jack.

SECTION 6

MAINTENANCE

6.1 This section contains information needed to calibrate and maintain the TTS 41-2A Service Analyzer Unit.

6.2 TEST SET ALIGNMENT

6.3 The following paragraphs provide a complete set of adjustment procedures for the analyzer. These procedures can be used for periodic maintenance or after repair of the analyzer. These procedures require precision laboratory test equipment. Personnel performing these procedures must be familiar with the equipment specified. No attempt to calibrate this ins ment should be made without the proper test equipm or qualified personnel.

6.4 TEST EQUIPMENT REQUIRED

6.5 Table 6—1 lists the type of equipment required align the analyzer. Select the equipment capable meeting the requirements listed in Table 6—1. Comm tools and cables are not listed.

Table 6—1. Test Equipment Required

EQUIPMENT	USE
Digital Voltmeter	To measure dc voltages of ± 10 volts with an accura of ± 10 millivolts.
Analog Voltmeter	To measure ac voltages (+10 dBm to −40 dBm acr 600 ohms) with an accuracy of ± 0.1 dB.
Function Generator	To supply ac reference levels (+10 dBm to −40 d into 600 ohms) with an accuracy of ± 0.1 dB. generator must have an output impedance of 600-ohr The generator must also have the capability to gate output signal with a 1 cycle per second square w (50% duty cycle).
Frequency Counter	To count signals with frequency ranging from 1 H 1200 Hz with an accuracy of ± 0.5%.
Step Attenuator	To reduce the output of the function generator by to 33 dB. The attenuator must have 10-dB and 1-dB s increments.
Oscilloscope	To display waveforms, should have a 5-MHz bandwid
Extender Board	To make test points on pc boards easily accessible.

PREPARATION FOR ALIGNMENT

Preparation for alignment consists of removing the er from its carrying case to expose all adjustments. cation diagrams (Figures 7—22, 7—24, and 7—26) the adjustment locations. Before beginning align- of the analyzer all test equipment should be allowed rm-up for the period specified by the test equip- manufacturers.

Remove the analyzer case cover.

Loosen and remove the eight sets of screws and ers securing the analzyer to the carrying case.

Carefully lift out the analzyer and place it on a conducting work surface.

Loosely secure the screws and washers in the ing case for safekeeping.

Loosen and remove two sets of screws and washers ring the pc card retainer.

Remove the pc card retainer.

Loosely secure the screws and washers to the cage for safekeeping.

ASSEMBLY ALIGNMENT

The analog assembly, the monitor detector as- bly, and the sequencer assembly may be aligned pendently of each other. Each assembly alignment esented as a series of check and adjustment pro- ures for easy reference. The series of procedures any one assembly must be performed in the order ented since some of the adjustments may depend h previous adjustments. In addition, the procedures me that positions of the switches and controls re- in their previously specified positions unless spe- ally instructed to set at new positions.

MONITOR DETECTOR A11 ALIGNMENT

Monitor Detector Assembly Preliminary Set-

Set the analyzer FUNCTION switch at POWER

2. Insert a dummy 310 plug into a CIRCUIT UNDER TEST jack.

3. Set the analyzer switches and controls as follows:

Dialing Programmer switch A at 1 and switch B at S
OPERATE at DISC
TRACE TONE at OFF
START DIAL at DELAYED
FAULT ALARM at OFF
CKT SEL at AUTO
REV CHK at OFF
"C" LEAD CHK at OFF
LOOP RES at NORM
LINE LEAK at NORM
DIAL SPEED at 10
ID at mid range.

4. Connect a −48 Vdc power source to the analyzer.

5. Set FUNCTION switch at SINGLE CALL.

6.12 Monitor Volume Adjustment

NOTE

The adjustment is only required if the audio volume has not been previously set at low but comfortable listening level.

1. Set up the test equipment as shown in Figure 6—1.

2. Set the attenuator at 20 dB.

3. Set the function generator for a 1000 ± 10 Hz continuous sinewave. Adjust the function generator level to obtain −20 ± 3 dBm on the analog voltmeter.

4. Set analyzer OPERATE switch at SINGLE CKT. Wait for analyzer to complete a test call (TEST OK indicator lights up).

5. Adjust the function generator level to obtain −20.0 ± 0.5 dBm on the analog voltmeter.

6. Adjust the analyzer MONITOR VOLUME control to obtain a comfortable listening level.

7. Disconnect attenuator output from the analzyer.

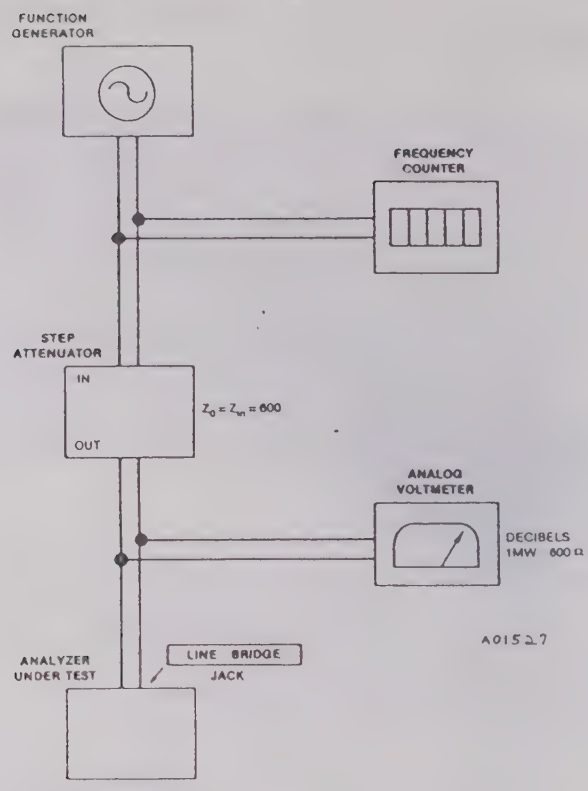


Figure 6—1. Test Equipment Set Up

6.13 Fault Alarm Adjustment

1. Set "C" LEAD CHK switch at ON.

2. Toggle OPERATE switch from SINGLE CKT to DISC and back to SINGLE CKT. Wait for analyzer to complete test call (FAULT and LOSS OF "C" GND indicators light up).

3. Set FAULT ALARM switch at INT ON.

4. Adjust INT ALM potentiometer R45 to obtain a comfortable listening level.

5. Set FAULT ALARM switch at RESET then at INT OFF.

6. Set "C" LEAD CHK switch at OFF.

6.14 Trace Tone Level Adjustment

1. Set up the analog voltmeter to measure −20 dBm across 600 ohms.

2. Connect the analog voltmeter to the analyzer LINE BRIDGE jack (use either a 310-type plug or a dual banana plug).

3. Set TRACE TONE switch at ON.

NOTE

The meter needle will oscillate about an average reading. The amplitude of oscillation depends on the damping of the meter movement.

4. Observe that analog voltmeter average readi −20.0 ± 0.5 dBm. If necessary, adjust TT LE potentiometer R43 to obtain an average reading −20.0 ± 0.5 dBm.

5. Set TRACE TONE switch at OFF.

6. Disconnect the analog voltmeter from the anal

6.15 Dial Mute Adjustment

NOTE

MUTE potentiometer R44 is factory set at mid-range. This control should not need adjustment unless the dial pulsing heard on the monitor is too loud.

1. Set OPERATE switch at DISC and FUNCT switch at POWER OFF.

2. Remove the dummy plug and connect a telep circuit to a CIRCUIT UNDER TEST connector.

3. Set dialing programmer switches A through R

4. Set FUNCTION switch at SINGLE CALL OPERATE switch at SINGLE CKT.

NOTE

To repeat step 5, toggle OPERATE switch from SINGLE CKT to DISC back to SINGLE CKT after dialing is completed.

5. During the dialing periods (a CIRCUIT UN TEST indicator blinks), adjust MUTE potentiom R44 for a comfortable listening level. The listening should **not** be set too loud.

6. Set OPERATE switch at DISC and FUNCT switch at POWER OFF.

7. Disconnect the telephone circuit from the ana and replace with a 310-type dummy plug.

SEQUENCER A10 ALIGNMENT

Sequencer Assembly Preliminary Set-Up

et analyzer FUNCTION switch at POWER OFF.

nsure that the analyzer is **not** connected to a source.

CAUTION

andle the sequencer assembly by the oard edges only. When necessary, place he board on a non-conducting surface.

Remove the sequencer assembly from slot 2 of rd cage.

nsert the card extender into slot 2 and connect quencer assembly into the card extender.

nsert a dummy 310 type plug into a CIRCUIT ER TEST jack.

Set the analyzer switches and controls as follows:

ig programmer switch A at 1 and switch B at S
ATE at DISC
E TONE at OFF
RT DIAL at DELAYED
T ALARM at OFF
SEL at AUTO
CHK at OFF
LEAD CHK at OFF
RES at NORM
LEAK at NORM
SPEED at 10
mid range

Connect a −48 Vdc power source to the analyzer.

CAUTION

All measurements on the sequencer assembly are taken with respect to −10 Vdc. Therefore the inputs of all test equipment must not connect to office ground but must float.

Set FUNCTION switch at SINGLE CALL.

On-Hook Timer Adjustment

Connect the oscilloscope to test points TP2 and (signal common, −10 Vdc).

Observe that the oscilloscope waveform has a ± 2 ms period. If necessary, adjust ON HOOK potentiometer R46 to obtain a 62 ± 2 ms period.

6.19 **Fault Timer Adjustment**

1. Connect the oscilloscope to test points TP1 and TP6 (signal common, −10 Vdc).

2. Observe that the oscilloscope waveform has a 700 ± 20 ms period. If necessary, adjust FLT potentiometer R48 to obtain a 700 ± 20 ms period.

6.20 **Delay Timer Adjustment**

1. Connect the oscilloscope to test points TP3 and TP6 (signal common, −10 Vdc).

2. Set OPERATE switch at SINGLE CKT.

NOTE

After a 4-second delay, the waveform should appear on the oscilloscope for 4 seconds during a test call. To repeat step 3, toggle OPERATE switch from SINGLE CKT to DISC and back to SINGLE CKT.

3. Observe that the oscilloscope waveform has a 62 ± 2 ms period. If necessary, adjust DELAY potentiometer R47 to obtain a 62 ± 2 ms period.

6.21 **Replacing The Sequencer Assembly**

1. Disconnect the oscilloscope.

2. Set OPERATE switch at DISC and FUNCTION switch at POWER OFF.

3. Disconnect the −48 Vdc power source from the analyzer.

CAUTION

Handle the sequencer assembly by the board edges only. When necessary, place the board on a non-conducting surface.

4. Replace the sequencer assembly into slot 2 of the card cage.

6.22 ANALOG A9 ALIGNMENT

6.23 **Analog Assembly Preliminary Set-Up**

1. Set analyzer FUNCTION switch at POWER OFF.

2. Ensure that the analyzer is **not** connected to a power source.

CAUTION

Handle the analog assembly by the board edges only. When necessary, place the board on a non-conducting surface.

3. Remove the analog assembly from slot 3 of the card cage.

4. Insert the card extender into slot 3 and connect the analog assembly into the card extender.

5. Insert a dummy 310-type plug into a CIRCUIT UNDER TEST jack.

6. Set the analyzer switches and controls as follows:

Dialing Programmer switch A at 1 and switch B at S
OPERATE at DISC
TRACE TONE at OFF
START DIAL at DELAYED
FAULT ALARM at OFF
CKT SEL at AUTO
REV CHK at OFF
"C" LEAD CHK at OFF
LOOP RES at NORM
LINE LEAK at NORM
DIAL SPEED at 10
ID at midrange

7. Connect a −48 Vdc power source to the analyzer.

8. Set FUNCTION switch at SINGLE CALL.

CAUTION

All measurements on the analog assembly are taken with respect to −10 Vdc. Therefore the inputs of all test equipment must not connect to office ground but must float.

6.24 Milliwatt Frequency Adjustment

1. Set up the test equipment as shown in Figure 6−1.

2. Set the attenuator at 0 dB.

3. Set the function generator for a 1004 ± 1 Hz continuous sinewave. Adjust the function generator level to obtain 0 ± 3 dBm on the analog voltmeter.

4. Set OPERATE switch at SINGLE CKT. Wait for analyzer to complete a test call. (Either the TEST OK or the FAULT indicator lights up).

5. Connect the dc voltmeter to test points TP2 and TP6 (signal common, −10 Vdc).

6. Adjust function generator level to obtain 0.0 ± 0.5 dBm on the analog voltmeter

7. Adjust indicator L1 for maximum positive voltage reading on the dc voltmeter.

6.25 Milliwatt Level Adjustment

1. Set the attenuator at 33 dB.

2. Adjust the function generator frequency to 975 ± 1 Hz. Adjust the function generator level to obtain −33.0 ± 0.5 dBm on the analog voltmeter.

3. Connect the dc voltmeter to test points TP1 and TP6 (signal common, −10 Vdc).

4. Set MW LEVEL potentiometer R44 full counterclockwise then adjust it to the point where the dc voltmeter reading **just** changes from a positive voltage (approximately +8V) to zero volts (logic 1 to logic 0 transition).

5. When properly aligned, the milliwatt detector circuit meets the requirements shown in Figure 6−2. That is, test point TP1 changes logic states between 900 Hz and 960 Hz and between 1055 Hz and 1150 Hz for a 0 dBm input level. Similarly, test point TP1 changes logic states between 940 Hz and 975 Hz and between 1035 Hz and 1080 Hz for a −30 dBm input level.

6. Disconnect dc voltmeter.

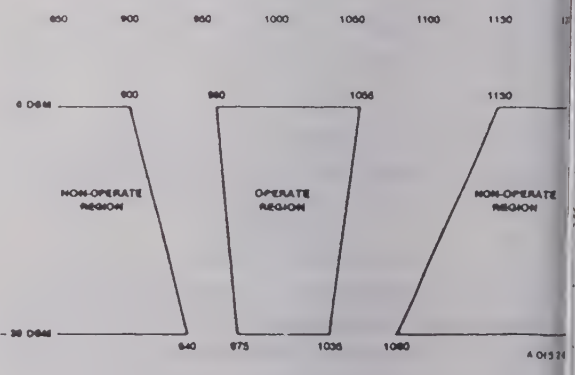


Figure 6−2. Milliwatt Operate/Non-Operate Regions

Test Okay Timer Adjustment

Set the attenuator at 0 dB.

Adjust the function generator frequency to 1004 Hz. Adjust the function generator level to obtain ± 0.5 dBm on the analog voltmeter.

Connect the oscilloscope to test points TP3 and (signal common, – 10 Vdc).

Toggle OPERATE switch from SINGLE CKT to and back to SINGLE CKT.

NOTE

The waveform appears on the oscilloscope after dialing is completed for only 4 seconds during a test call. To repeat step 5, toggle OPERATE switch from SINGLE CKT to DISC and back to SINGLE CKT.

Observe that the oscilloscope waveform has a 2 ms period. If necessary, adjust T-OK potentiometer R45 to obtain a 62 ± 2 ms period.

Disconnect the oscilloscope and remove the attenuator output from the analyzer.

Offset Adjustment

Connect the dc voltmeter to test points TP4 and (signal common, – 10 Vdc).

Observe that the dc voltmeter indicates 0.0 ± 1.0 If necessary, adjust OFFSET potentiometer R53 obtain a 0.0 ± 1.0 mV reading on the dc voltmeter.

Disconnect the dc voltmeter.

Busy Level Adjustment

Reconnect the attenuator output to the analyzer.

Set the attenuator at 33 dB.

Adjust the function generator frequency to 400 ± z. Adjust the function generator level to obtain .0 ± 0.5 dBm on the analog voltmeter.

Gate the 400-Hz signal for 500 ms every second z square wave with 50% duty cycle).

Connect the oscilloscope to test points TP7 and (signal common, – 10 Vdc).

6. Set BUSY LEVEL potentiometer R52 fully clockwise then adjust it to the point a square waveform just appears on the oscilloscope.

6.29 **Busy Timer Adjustment**

1. Connect the oscilloscope to test points TP5 and TP6 (signal common, – 10 Vdc).

2. Toggle OPERATE switch from SINGLE CKT to DISC and back to SINGLE CKT.

NOTE

The waveform appears on the oscilloscope after dialing is completed for only 8 seconds during a test call. To repeat step 3, toggle OPERATE switch from SINGLE CKT to DISC and back to SINGLE CKT.

3. Observe that the oscilloscope waveform has a 100 ± 2 ms period. If necessary, adjust BUSY TIMER potentiometer R47 to obtain a 100 ± 2 ms period.

6.30 **Busy Level Performance Check**

NOTE

This check verifies the performance of the busy level detector circuit and may be omitted.

1. Connect the oscilloscope to test points TP7 and TP6 (signal common, – 10 Vdc).

2. Set the attenuator at 0 dB.

3. Adjust the function generator level to obtain 0 ± 0.1 dBm on the analog voltmeter.

4. Observe that the oscilloscope shows a logic one level (approximately +8V).

5. Increase the attenuator setting by 10 dB. Observe that the level switches to logic zero (approximately 0V). Several seconds later the level returns to logic one.

6. Repeat step 5 three more times. Each time the level should switch to logic zero. For a 40 dB attenuation setting, the level should remain at logic zero.

7. Adjust the function generator frequency to 200 ± 5 Hz and repeat steps 2 through 6.

8. Adjust the function generator frequency to 800 ± 5 Hz and repeat step 2 through 6.

6.31 Replacing The Analog Assembly

1. Disconnect the oscilloscope and remove the attenuator output from the analyzer.

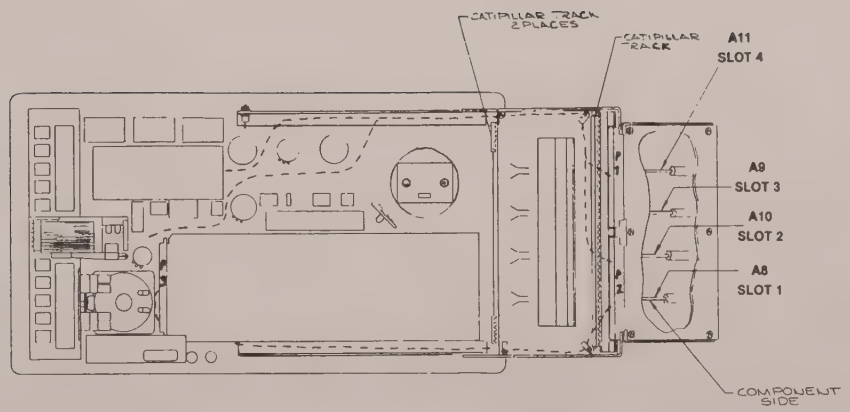
2. Set OPERATE switch at DISC and FUNCTION switch at POWER OFF.

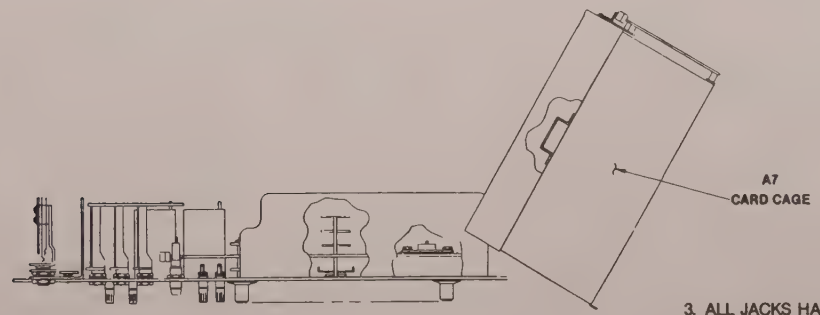
3. Disconnect the −48 Vdc power source from the analyzer.

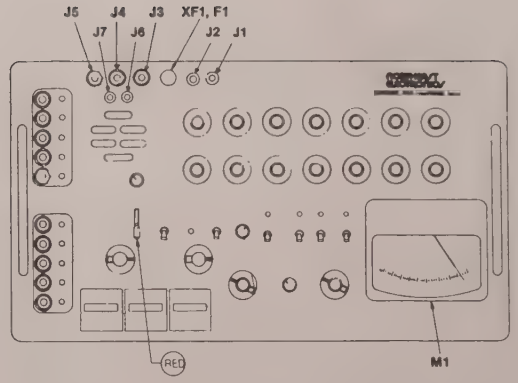
CAUTION

Handle the analog assembly by the board edges only. When necessary, place the board on a non-conducting surface.

4. Replace the analog assembly into slot 3 of t card cage.







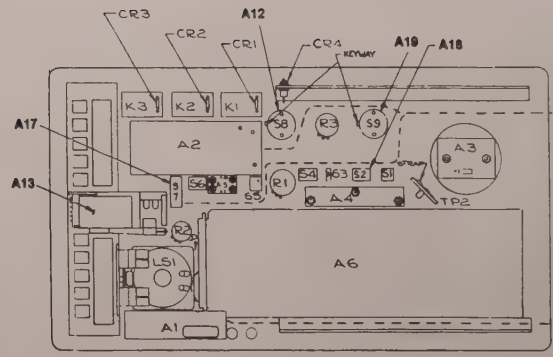


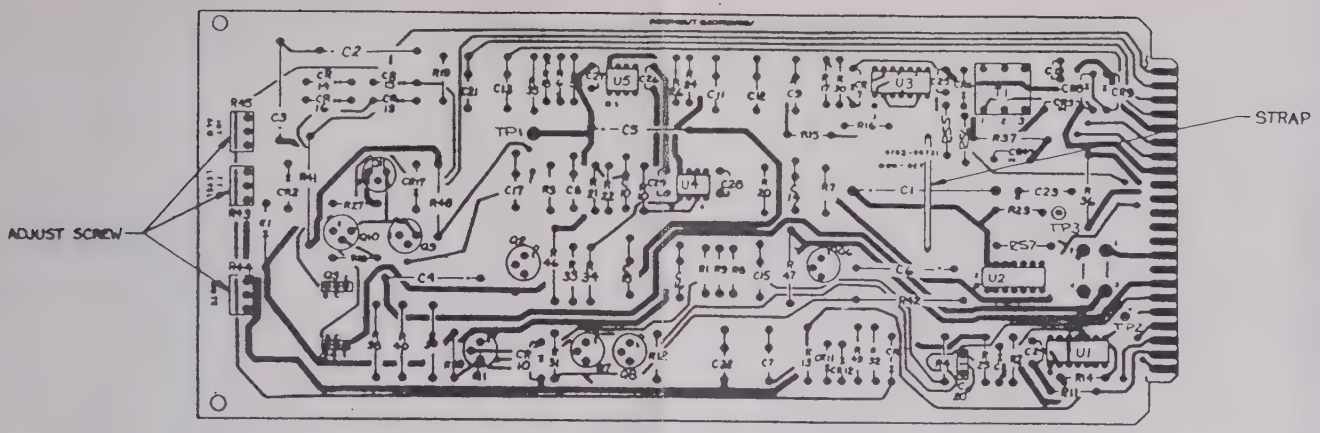
Figure 7—5. TTS 41-2A Service Analyzer Unit

3. ALL JACKS HAVE AN INSULATED SHOULDER WASHER AT THE REAR OF THE FRONT PANEL AND HAVE AN INSULATED FLAT WASHER AT THE FRONT OF THE FRONT PANEL.

2. SPEAKER SCREEN MOUNTED BETWEEN SPEAKER LS1 AND FRONT PANEL.

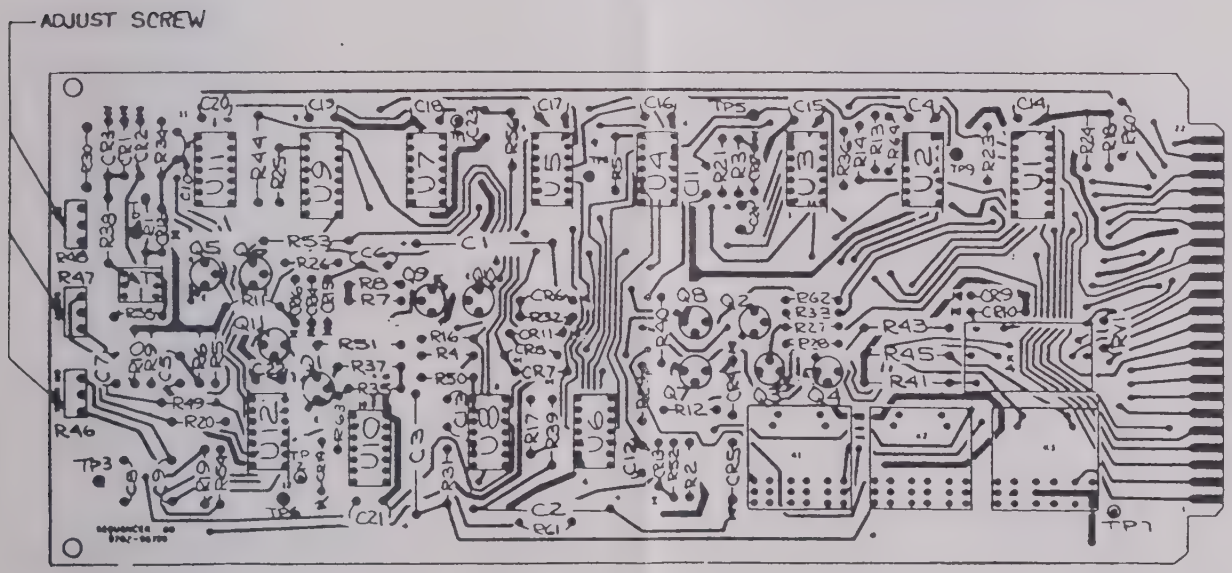
1. DIODE CR4 INSULATED FROM CHASSIS.

NOTES:



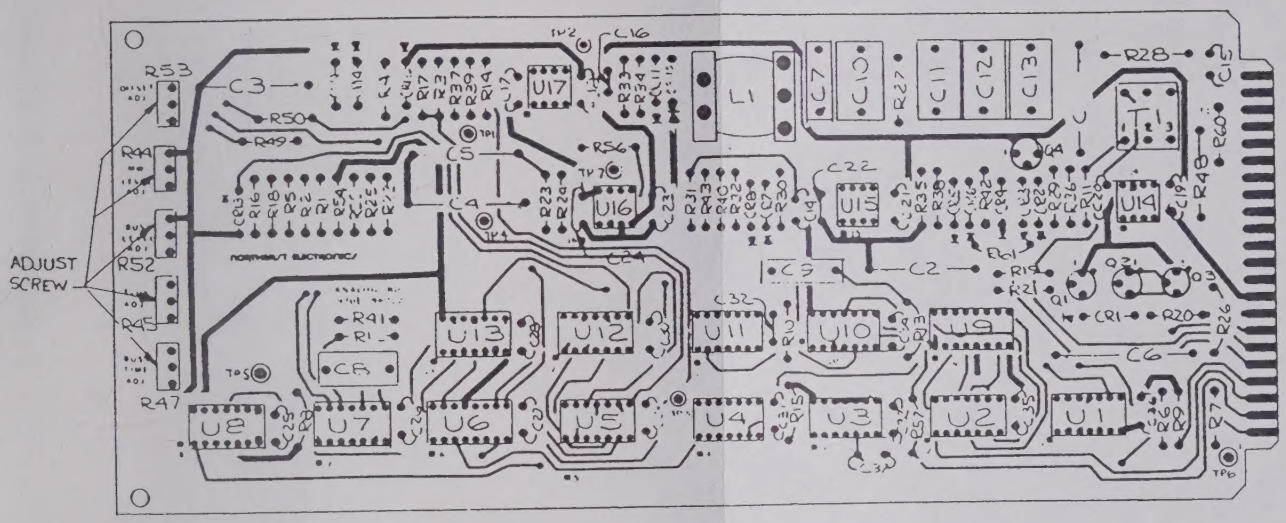
Monitor Detector	
NE PART NO.	C0041-12-034
REF DESIG	A11
PC NO.	96721
CARD SLOT	4

Figure 7—26. Monitor Detector A11,



Sequencer	
NE PART NO.	C0041-12-033
REF DESIG	A10
PC NO.	96720
CARD SLOT	2

Figure 7—24. Sequencer A10,
Parts Location Diagram



Analog	
NE PART NO.	C0041-12-035
REF DESIG	A9
PC NO.	96797
CARD SLOT	3

Figure 7—22. Analog A9, Parts Location Diagram

ACCOPRESS®

25970	YELLOW
25971	BLACK
25972	LIGHT BLUE
25973	DARK BLUE
25974	LIGHT GRAY
25975	LIGHT GREEN
25976	DARK GREEN
25977	TANGERINE
25978	RED
25979	EXECUTIVE RED

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